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RECENT USSR WORK IN THE FIELD OF MICROBIOLOGY

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In the field of general microbiology, one may note investigations by N. N. Zhukov-Verezhnikov, V. D. Timakov, G. P. Kalina, P. T. Grinbaum, and V. A. Kres-tovnikova that deal with processes of modification, with filterable forms and phases of the development of microorganisms, and with the formation of microbial species, i.e., investigations which are concerned with problems of heredity and modifiability of microorganisms. Some of the results obtained in these investigations are doubtful and require further checking. However, these investigations represent an original trend of Soviet microbiology which is opposed to the prevalent tendencies of research in capitalistic countries. Microbiological research in capitalistic countries is unproductive because it is held back by the reactionary theories of Weismann and Morgan. We should persist in expanding research in this particular subdivision of general microbiology and in doing so, follow the new trend established in the USSR.

The nature of the filterable forms of microbes has not yet been clarified. Some investigators (G. P. Kalina) treat these forms as regular stages of development, while others (S. N. Muromtsev) regard them as fragments of vegetative forms and assume that these fragments are capable of regeneration [into the original microorganisms].

The methods of working with filterable forms have not been adequately developed as yet, so that the results obtained by different investigators differ from each other. The relationship between these forms and noncellular living matter is not quite clear. Also many points are not quite clear as far as the interpretation of phase development of microbes is concerned: treatment of this subject in published papers is far from being uniform. There is still no generally accepted definition of the concept of species in microbiology, so that a serious lag exists in the systematization and nomenclature of bacteria. There is also no general agreement on many problems of species formation.

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Besides new and valuable work in the fields of heredity and modifiability, several immature publications have appeared recently. These publications reported results which are not based on factual data and for that reason had the effect of introducing much confusion into general theoretical microbiology. The authors of these superficial investigations (G. M. Bosh'yan, M. D. Utenkov, S. I. Berulava) attempt to hide the scarcity of facts by purely speculative guesswork and present under the guise of new discoveries outlived theories which were disproved long ago.

The theory of heredity, modifiability, and species formation touches on many important problems, including those connected with the theory and practice of inoculation. During recent years, Soviet microbiologists (N. N. Gayskiy, P. A. Vershilova, N. N. Ginzburg, and others) have developed a number of highly effective vaccines against tularemia, brucellosis, anthrax, and plague. Killed vaccines and other preparations for active immunization against intestinal infections, diphtheria, tetanus, leptospiroses, and other diseases have been considerably improved. As a result of the introduction of modern technological methods into the production of vaccines, the quality of vaccines was raised sharply. However, some problems in this field remain unsolved. First, there are no vaccines or other preparations for active immunization against whooping cough, scarlet fever, and several other diseases that are of considerable relative importance. Secondly, some of the vaccines used at present (dysentery vaccine, polyvalent vaccine) have a low activity, so that the advisability of continuing their use is in doubt. Thirdly, we have not yet learned how to stabilize the immunogenic properties of vaccine strains: some of these strains gradually lose their valuable properties.

One of the most important aspects of general microbiology is the study of the biochemistry of bacteria and of the chemistry of antigens. A. M. Kuzin, N. V. Kholchev, and other Soviet investigators have done a considerable amount of work in this field. In their investigations, the bankruptcy of the foreign theory of "full antigens" was demonstrated and the possibility of obtaining highly immunogenic complexes of a different type shown. One the whole, this subdivision of microbiology, which is of great importance from the standpoint of possible applications (i.e., in connection with the preparation of so-called chemical vaccines), does not keep up with the requirements put to it by practical antiepidemic work.

The study of the antagonism of microorganisms, which is a branch of general microbiology, leads to the investigation of antibiotics, and the latter, in turn, touches on chemotherapy. As a result of research done by Z. V. Ermol'yeva, G. F. Gauze, Kh. Kh. Planel'es, F. S. Khanenya, V. S. Derkach, et al., USSR public health protection has at its disposal the excellent antibiotics of penicillin, synthomycin, albomycin, biomycin, gramicidin, and sanazin. Although antibiotics are of unquestioned value in the treatment of infectious diseases, experience in their use on a mass scale established that not one of them frees the human body of bacteria. In some cases the application of antibiotics transforms the patients into bacillus carriers (Kh. Kh. Planel'es) or results in the appearance of drug-resistant forms of microorganisms (V. L. Troitskiy). Further research in regard to the action of antibiotics on both the macroorganism and the microorganisms which infect it is indicated. A search must also be made for more active antibiotics and methods found for combating the drug resistance of microorganisms.

It is essential to devise a USSR system of classification and nomenclature of microorganisms that would correspond to new data in this field and to the new treatment of microbiological problems from the standpoint mentioned above. Furthermore, it is necessary to develop a theoretical basis and practical methods for work on the directed modification of bacteria so that highly immunogenic strains may be obtained for the production of live as well as killed vaccines, and so that stable hereditary transmission of properties desirable in this respect may be established.

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Work in several divisions of special microbiology is no less important than research in general microbiology. The most important fields of special microbiology are reviewed below.

As far as intestinal infections are concerned, prophylaxis of dysentery presents the most important problem. Work done by V. L. Troitskiy, V. D. Timakov, V. A. Chernokhovstov, E. M. Novgorodskaya, and others has contributed much that is new to research on the etiology, diagnosis, and specific prophylaxis of dysentery. Nevertheless, the USSR Public Health Service does not yet have reliable agents for the specific prophylaxis of this infection. The existing subcutaneous and enteral vaccines are not very effective. Reliable methods for establishing a bacteriological diagnosis, which is important in chronic and symptom-free cases, are not available as yet. It is necessary to solve these problems. Furthermore, microbiologists must participate in work on the development of efficient methods of therapy for this disease. It is also necessary to settle in one way or another the question in regard to the advisability of using dysentery bacteriophage for prophylactic purposes at foci of infection.

It is important that work be continued on the development of an effective polyvalent vaccine against intestinal diseases (typhoid, paratyphoids, dysentery, cholera) because the existing preparations do not satisfy the requirements set to them. Finally, the problem of rendering harmless the chronic carriers of typhoid-paratyphoid bacteria still remains to be solved.

One of the fields of special microbiology in which little work has been done is the specific prophylaxis of children's infectious diseases (scarlet fever, whooping cough, and diphtheria), i.e., development of effective methods for the specific immunization against these diseases. As far as the three infections mentioned above are concerned, the best results have been achieved in connection with diphtheria. It is well known that compulsory immunization of children with diphtheria anatoxin has led to a lowering of the incidence of this disease. It appeared later, however, that immunized children younger than 4 years and older than 12 years still got diphtheria, although much more seldom than children who had not been immunized. This finding resulted in attempts, both in the USSR and abroad, to obtain a more highly immunogenic preparation, i.e., a concentrated anatoxin. A concentrated diphtheria anatoxin recently developed in the USSR will be introduced into practical use in the near future.

The situation with regard to specific prophylaxis of scarlet fever is much worse. At present, the majority of USSR scientists agree with G. N. Gabrichvskiy's view to the effect that the hemolytic streptococcus is the causative factor of this disease and that the toxin of this streptococcus is of decisive importance in the pathogenesis of scarlet fever as well as in immunity against it. Large-scale attempts to achieve specific prophylaxis with the aid of streptococcus toxin were unsuccessful, however. The safe doses that had been used were not sufficiently effective, while larger doses would have been dangerous. One should abandon attempts to immunize against scarlet fever with toxin and try to develop an effective and innocuous agent of the anatoxin type for that purpose.

The problem of active immunization against whooping cough also has not been solved adequately. The preparations for that purpose developed by V. I. Ioffe, B. L. Palant, and others had a weak immunogenic activity and produced undesirable reactions. Work on this subject should receive more attention on the part of scientific research institutes.

Development of a satisfactory complex [triple] vaccine for active immunization against diphtheria, scarlet fever, and whooping cough must be regarded as the most important problem to be solved by microbiological research institutes. Some of the other problems in special microbiology which will require particular attention are development of more effective vaccines against tuberculosis and

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leptospiroses; further perfection of vaccines against anthrax, brucellosis, and tularemia; development of a complex preparation /polyvaccine/ for immunization against anaerobic infections, i.e., gas gangrenes and tetanus; and research on questions of special chemotherapy and of therapy by means of antibiotics.

In conclusion, the importance of developing rapid and reliable methods for the diagnosis of infectious diseases must be emphasized. After new diagnostic nutrient media for the isolation of dysentery bacilli (e.g., Bactoagar Zh) had been introduced into practice, bacteriological diagnosis of dysentery became one of the most reliable methods for recognizing this disease. A similar result was achieved by introducing the hemoculture method as a procedure for diagnosing typhoid-paratyphoid. Although diagnosis is one of the most important links in the chain of measures applied against infectious diseases, development of diagnostic procedures lags conspicuously behind the requirements of anti-epidemic practice. Thus, the available methods for the bacteriological diagnosis of scarlet fever has, in effect, been developed: the detection of hemolytic streptococci in the pharynx cannot serve as a criterion for setting a reliable diagnosis for scarlet fever.

Work should be done on the improvement and standardization of the diagnostic preparations which are being supplied, the development of highly sensitive selective and differential nutrient media for diagnosis, the finding of sensitive methods for the detection of specific bacterial antigens, and the use of immunological reactions. It is particularly important to develop rapid methods for the diagnosis of infectious diseases and for the detection of pathogenic microorganisms in the environment.

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